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**DETAILED ACTION**

**Claim Rejections - 35 USC § 103**

Claims 1 and 12-25 rejected under 35 U.S.C. 103(a) as being unpatentable over Linstid, III et al (US Patent 6222000), herein Linstid in combination with Furuta et al (US Patent 5612101), herein Furuta.

Linstid discloses amorphous wholly aromatic polyester amide exhibiting optical anisotropy obtained by copolymerizing:

- A 4-hydroxybenzoic acid-15-60%, preferably 20-40%
- B 2-hydroxy-6-naphtic acid 15-60%, preferably 20-40% (meeting limitation (3) of Claim 1, since ratio A/B is always within the range of 0.15-4)
- C 4-aminophenol 5-20%, preferably 10-15% (meeting limitation (1) of Claim 1)
- D isophthalic acid 7-15 %, preferably 10-15% (see Claim 16) (meeting limitation (2) of Claim 1, since isophthalic acid)
- E terephthalic acid 5-20% , preferably 10-15% (Columns 3-4)

Linstid teaches that his liquid crystal copolymers can be used in a composition with Polyolefins, (such as Polyethylene or modified PE) which have melting point below 230C, meeting the limitation of Claim 1. (Typical Tm for HDPE is about 140C).

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Glass transition temperatures, of the above copolymers are about 150C (Column 6, line 5), whereas melting point  $T_m$  is not observed (Column 5, line 65), which indicates that the above copolymers are amorphous. DSC measurements are made at 20 C/min temperature rising rate (Column 17, line 45).

Note that Linstid copolymer contains terephthalic acid, which is not claimed in Claim 1. However, this component is not prohibited in the Claim 1.

Regarding Claims 13, 19 and 25 Linstid discloses that his copolymers are melt-processable below 270C (Column 6, line 5).

Linstid teaches that the above liquid crystal copolymers may be used in combination with polyolefins and modified polyolefins, (Example 26, Column 24 and Column 3, line 10) for production of films, sheets, fibers, multi-layer laminates, blow-molded containers and other articles. (Column 16, line 20). Thus the limitations of Claims 12-22 and 25 are met.

Regarding Claim 23, Linstid does not specify that a polyethylene he discloses for multilayered applications is HDPE. However, such articles as bottles, tanks and containers typically producing from HDPE. HDPE has a significant advantage over LDPE in terms of mechanical strength, which is critical for the above applications.

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Linstid does not teach a ratio between the resins in the composition based on the above liquid crystal copolymers. Also, he fails to disclose that polyethylene in blow-molded article is high density polyethylene. In addition Linstid does not disclose that his liquid crystal composition can be processed into fuel tank. Hence the attention is directed towards Furuta. Linstid and Furuta are analogous art because they are from the same field of endeavor, utilizing liquid crystal polymers.

Furuta teaches a liquid crystal polyester resin composition film made of a liquid crystal polyester resin composition comprising (A) preferably 70 through 98% by weight of a liquid crystal polyester and (B) preferably 30 through 1% by weight of a thermoplastic resin (polyolefin, modified polyolefin, etc. (Column 10, line 10), by blown film extrusion or by laminating. The above liquid crystal polyester resin composition has an improved behavior in molten state which has been extraordinary in and drawback of the conventional liquid crystal polyesters and is easily molded into a film with excellent mechanical strength heat resistance and gas-barrier properties and gasoline-barrier properties (Abstract).

Furuta discloses that at above ratios liquid crystal polymer forms a continuous phase and other thermoplast forms a disperse phase. With increased content of thermoplast a moldability deteriorates and mechanical strength and barrier properties lowers. (Column10, line 15).

Therefore, it would have been obvious to a person with ordinary skills in the art to combine liquid crystal and thermoplastic resin in order to improve physical properties of a final molded article. In order to obtain excellent mechanical properties, typical for liquid crystal copolymers it is important that liquid crystal polymer forms a continuous phase and other thermoplast forms a disperse phase. When the amount of dispersed phase exceeds 25-30%, two continuous phases formed. In this case values of most important mechanical properties, such as Young modulus, decrease. Therefore, it is important to keep a content of thermoplastic polymer in the composition below 30% wt.

Regarding Claim 23, Furuta discloses that polyethylene in his composition is high density polyethylene (HDPE) (Example 6, column 17).

Since HDPE has much better mechanical properties than LDPE due to its higher crystallinity it would have been obvious to a person with ordinary skills in the art to use HDPE for high end applications, such as large blow molded containers.

Regarding Claim 24, Furuta discloses that his composition can be processed into a fuel tank (Comparative Example 6, Column 18).

Since Linstid composition has an exceptional mechanical and barrier properties and ability to be processed by blow molding, it would have been obvious to a person with

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ordinary skills in the art to use a composition based on Linstid copolymers for manufacturing of fuel tanks.

Claims 6-10 rejected under 35 U.S.C. 103(a) as being unpatentable over Charbonneau et al (US Patent 4351918), herein Charbonneau in combination with Furuta

Charbonneau discloses liquid crystal copolymer comprising:

- (A ) 40% 4-hydroxybenzoic acid,
- (B) 20% 2-hydroxy-6-naphtoic acid (meeting limitation (3) of Claim 6, since ratio A/B is always within the range of 0.15-4)
- (C) 20% terephthalic acid (or isophthalic acid Column 6, line 15) (in case when Isophthalic acid is used, meeting limitation (2) of Claim 6),
- (D) 5% p-phenylenediamine, (meeting limitation (1) of Claim 6)
- (E) 20% 2,6 dihydroxyanthraquinone.

Glass transition temperature, measured by DSC at temperature rising rate of 20C/min is 122C, whereas distinctive T<sub>m</sub> transition is not observed (Column 17, Example 6). Therefore, limitations (4) and (5) of claim 6 are met.

Regarding Claims 7-10, Charbonneau teaches that terephthalic acid can be completely replaced by isophthalic acid (which have 1, 3 phenylene skeleton), which is a bending monomer.

Note that Linstid copolymer contains 2,6 dihydroxyanthraquinone, which is not claimed in Claim 6. However, this component is not prohibited in the Claim 6.

Charbonneau does not teach a composition based on the above copolymer. Hence attention is directed to Furuta. Charbonneau and Furuta are analogous art since they are from the same field of endeavor, utilizing liquid crystal copolymers.

Furuta teaches a liquid crystal polyester resin composition film made of a liquid crystal polyester resin composition comprising (A) preferably 70 through 98% by weight of a liquid crystal polyester and (B) preferably 30 through 1% by weight of a thermoplastic resin (polyolefin, modified polyolefin, etc. (Column 10, line 10)

The above liquid crystal polyester resin composition has an improved behavior in molten state which has been extraordinary in and drawback of the conventional liquid crystal polyesters and is easily molded into a film with excellent mechanical strength heat resistance and gas-barrier properties (Abstract). Furuta discloses that at above ratios liquid crystal polymer forms a continuous phase and other thermoplast forms a disperse phase. With increased content of thermoplast a moldability deteriorates and mechanical strength and barrier properties lowers. (Column10, line 15)

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Therefore, it would have been obvious to a person of ordinary skills in the art to combine liquid crystal and thermoplastic resin in order to improve physical properties of a final molded article. In order to obtain excellent mechanical properties, typical for liquid crystal copolymers it is important that liquid crystal polymer forms a continuous phase and other thermoplast forms a disperse phase. When the amount of dispersed phase exceeds 25-30%, two continuous phases formed. In this case values of most important mechanical properties, such as Young modulus, decrease. Therefore, it is important to keep a content of thermoplastic polymer in the composition below 30% wt.

In addition, liquid crystal copolymers are very expensive. Partially replacing them with inexpensive polyolefin has a significant economical advantage.

Claim 11 rejected under 35 U.S.C. 103(a) as being unpatentable over Charbonneau and Furuta as applied to claims 6-10 above, and further in view of Hiroshi (JP publication 03-284726).

Charbonneau and Furuta teach that a composition based on liquid crystal copolymers and Polyolefins (see discussion above).

Charbonneau and Furuta do not teach that liquid crystal resin contains 1,3 phenylenediamine. Hence attention is directed to Hiroshi. Charbonneau and Hiroshi

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are analogous art since they are from the same field of endeavor, utilizing liquid crystal copolymers.

Hiroshi discloses a composition based on liquid crystal oriented film comprising dicarboxylic acid and 15 or more weight percent of 1,3-phenylenediamine. This composition has the large tilt angle and good adhesive properties, when combined with a substrate.

Therefore, it would have been obvious to a person with ordinary skills in the art to use 1,3-phenylenediamine in Charbonneau's liquid crystal and thermoplastic resin composition in order to improve adhesiveness between layers in the composition.

### ***Double patenting***

Claims 1 and 12-25 provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-14 of copending Application No. 10/525,642 in view of Furuta (see discussion above).

Although the conflicting claims are not identical, they are not patentably distinct from each other because the application claim the composition based on the same liquid crystal polymer as in the Application 10/525,642.

This is a provisional obviousness-type double patenting rejection.



***Response to Arguments***

Applicant's arguments filed 8/21/2007 have been fully considered but they are not persuasive.

In the above response the Applicant stated that "Specifically, in the Examples of Linstid III et al, no polymer containing p- aminophenol which further contains isophthalic acid is disclosed. That is, the wholly aromatic polyester amide as proposed by Linstid III et al is completely different structurally from that of the present invention containing p-aminophenol and isophthalic acid as the essential components".

In the present Rejection the Examiner relies on the full disclosure of Linstid, not only on the Examples and preferred embodiments (see MPEP 2123). The properties of the composition, such as adhesive strength depend on the ratios of components (claimed broadly in both Application examined and Linstid).

Applicant argues that "Furuta merely discloses blending a liquid crystal polyester (LCP) with an olefin". This is incorrect. Furuta discloses such a composition in the Abstract of his disclosure.

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Applicant argues that "According to Charbonneau, however, no "bending monomer" appears to be disclosed therein. In addition, the disclosed 2,6 - dihydroxyanthraquinone included in the polymer of Example 6 of Charbonneau is not a bending monomer." This is incorrect. Isophthalic acid is a bending monomer (see discussion above).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory Listvoyb whose telephone number is (571) 272-6105. The examiner can normally be reached on 9am-6pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, James Seidleck can be reached on (571) 272-1078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Gregory Listvoyb  
Examiner  
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